SHORT RESUME/ SYNOPSIS OF PH. D TOPIC

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STUDIES ON LUMPY SKIN DISEASE IN CATTLE

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SHORT RESUME/ SYNOPSIS OF PH. D TOPIC

STUDIES ON LUMPY SKIN DISEASEINCATTLE.

A BRIEF RESUME OF PROPOSED WORK / PROBLEM:

Lumpy Skin Disease (LSD) is a highly contagious viral infection that primarily affects cattle, causing characteristic skin lesions and nodules. The disease is caused by the LSD virus (LSDV), a member of the *Capripoxvirus* genus. LSD has gained considerable attention due to its potential to cause significant economic losses in the livestock industry and the potential for disrupting trade. LSDV is a complex and robust virus with a double-stranded DNA genome. It belongs to the Poxviridae family and is closely related to other economically important poxviruses affecting livestock, such as sheep and goat pox viruses. The disease was originally confined to certain regions but has spread to new territories, raising concerns about its global impact. LSD presents with a range of clinical signs, including fever, depression, and the hallmark skin lesions that give the disease its name. These skin nodules can be both painful and debilitating, leading to reduced milk production, weight loss, and decreased meat quality. Additionally, secondary infections and complications can further exacerbate the severity of the disease. The potential for LSDV to cause outbreaks and its ability to be transmitted through various means, including direct contact between animals and insect vectors, have prompted intensified research efforts to understand its epidemiology, pathogenesis, and potential control strategies. As the livestock industry continues to expand and globalization facilitates the movement of animals, the need for effective management and prevention of LSD becomes ever more critical.

Keeping view in mind about importance of Cattle, The present work is undertaken to study the Lumpy Skin Disease in Cattle from Nanded.

1. INTRODUCTION TO PROPOSED RESEARCH TOPIC:

Lumpy skin disease (LSD) is a viral disease that affects cattle. It is transmitted by blood-feeding insects, such as certain species of flies and mosquitoes, or ticks. It causes fever, nodules on the skin and can also lead to death, especially in animals that that have not previously been exposed to the virus. Lumpy skin disease is caused by the lumpy skin disease virus (LSDV), which belongs to the genus *Capripoxvirus*, a part of the poxviridae family and has emerged as a major concern for animal health due to its rapid spread and devastating consequences. As an arbovirus, LSDV transmission occurs primarily through insect vectors, with the involvement of both mechanical and biological means. The disease leads to severe cutaneous lesions, systemic manifestations, and a decline in overall animal productivity, resulting in substantial economic losses for livestock farmers. Understanding the transmission

dynamics of LSDV is crucial for designing effective control and prevention strategies. Investigating the virus's modes of transmission, range of susceptible hosts, and routes of infection will shed light on its ecological and epidemiological patterns.

The Haemato-Biochemical aspects of LSDV infection are equally important for comprehending the disease pathogenesis and host response. Analyzing the immune mechanisms triggered during infection can provide insights into vaccine development and immune-mediated control measures. Furthermore, monitoring the Haemato-Biochemical alterations induced by the virus is essential to gauge the severity of the disease and the potential for recovery in affected animals. The LSDV impacts animal health and productivity, it poses substantial economic burdens on cattle farmers. Evaluating the direct and indirect costs associated with LSDV outbreaks can guide policymakers and stakeholders in implementing effective disease control measures.

The proposed research work leading to Ph.D., aims to comprehensively investigate the transmission dynamics of LSDV, Haemato-Biochemical, Immunological and clinical aspects of cattle naturally infected with the virus. Additionally, the study will assess the economic implications of LSDV outbreaks on cattle production. By encompassing these multidisciplinary aspects, this research seeks to provide valuable insights that contribute to the development of evidence-based control strategies, aiming to mitigate the effect of Lumpy Skin Disease on cattle populations and safeguard the livelihoods.

2. REVIEW OF LITERATURE AND DEVELOPMENT IN THE RELEVENT SUBJECT:

The first description of the clinical sign of LSD was in 1929 in Zambia, Southern Africa, then it spread north to the Middle East (Weiss, 1968). In the beginning, LSD signs were considered to be the consequence either of poisoning or a hypersensitivity to insect bite. Same clinical signs were occurred in Botswana, Zimbabwe and the Republic of South Africa between 1943 and 1945, where the infectious nature of the disease was recognized in these outbreaks. Lumpy skin disease (LSD) is an emerging viral transboundary disease which can spread beyond the outbreak area and become epidemic (Jordi et al., 2018; K. A. Al-Salihi, 2014; Kumar et al., 2021). The most common clinical symptoms are nodular lesions on the surface of the skin and mucous membranes. Skin nodule lesions often appear on the outside of infected cattle, such as head, neck, back, perineum, breast, and other areas of the cattle (Molla et al., 2017). The affected cattle have varying degrees of edema and lameness in their legs (Salib and Osman, 2011). LSD is a viral contagious cattle disease caused by Lumpy skin disease virus (LSDV; Murphy et al., 2008). *Capripoxvirus* genus, subfamily

Chordopoxvirniae, family Poxviridae (Tulman et al., 2001; Bhanuprakash et al., 2006; Moss, 2007; K, 2014). Viruses of family poxiviride have similar structures. LSDV disease was spread to southern and eastern parts of China and the countries in South Asia, including Nepal, Bhutan, Vietnam, Thailand and Myanmar (Pseudo-urticaria, 1931; Mulatu and Feyisa, 2018; Arjkumpa et al., 2021; Punyapornwithaya et al., 2022).

In November 2019 lumpy skin disease in India was confirmed in a lab (Jolly, Bani; Scaria, Vinod, 2022). It was heavily spread into India in 2020, causes serious economic damage with high mortality rate in cattle. Latter on mortality rate decreases as hurd immunity develops in animals. The virus is stable in ambient conditions for long period. It can persist in desiccated skin crusts for 35 days, in necrotic nodules for 33 days and in air-dried hides for at least 18 days. Sunlight and lipid detergents can destroy virus quickly but virus can persist for many months in dark environment like animal sheds and feed stores. Virus gets inactivated at 55ºC temperature for 2 h and 65ºC for 30 min. (Tania Gupta, Vanita Patial, Diksha Bali, Shivani Angaria, Mandeep Sharma& Rajesh Chahota, 2020). The 2022 lumpy skin disease outbreak in India resulted in the death of over 97,000 cattle in three months between July to September. (Sharma, Harikishan, September,2022; Jolly, Bani; Scaria, Vinod, 2022; Bajeli-Datt, Kavita,2022). Starting from outbreaks in Gujarat and Rajasthan, in three months cattle in 15 states across India were affected (Sharma, Harikishan, September,2022).

Cattle (*Bos indicus* and *Bos taurus*) and buffalo (*Bubalus bubalis*) are susceptible hosts. *Bos taurus* is more susceptible than indigenous cattle breeds. Animals of all ages are susceptible but calves are more susceptible and develop lesions within 24 to 48 h (Al-Salihi 2014). Wild animals under natural conditions, are resistant to infection but experimental infection produced clinical lesions in Giraffe (*Giraffe camelopardalis*) and impala (*Aepyceros melampus*), Arabian oryx (*Oryx leucoryx*), springbok (*Antidorcas marsupialis*), and oryx (*Oryx gazelle*) and Thomson's gazelle (Davies 1991; Padilla et al. 2005). Normally the role of wildlife in the transmission and maintenance of LSDV has been found almost negligible.

Animal health affect due to LSDV infection causes major economic losses, productivity of animals. Regarding the economic losses due to LSD, various researchers have reported different figures but none concerning to India. The median losses per affected lactating cow was calculated to be USD 141 (INR 11510.85), USD 1000 (INR 81637.20) for dead cow and total economic loss of LSD outbreak at herd level to be USD 1176 (INR 96005.35) in Ethiopia (Molla et al., 2017). In Turkey, total economic loss of GBP 2093.99 (INR 204475.24) per herd was reported (Sevik and Dogan, 2017). Casal et al. (2018) while calculating the economic losses due to LSD reported a net loss of EUR 8.6 million in

Bulgaria, EUR 6.7 million in Former Yugoslav Republic of Macedonia and EUR 5.3 million in Albania. The same study reported the average cost per affected herd to be EUR 6994 (INR 590305.92), EUR 3071 (INR 259197.81) and EUR 869 (INR 73345.13) in Bulgaria, Former Yugoslav Republic of Macedonia and Albania respectively. Roche et al., (2020) has estimated a net loss of USD 1.45 billion due to LSD in South, East and Southeast Asian countries (Amandeep Singh, Gurpreet Kour, Sehajpal Singh Dhillon, Parkash Singh Brar., 2023).

4. OBJECTIVES OF THE RESEARCH AND PROPOSED HYPOTHESIS:

The objectives of the proposed study are as follows:

- To make survey of cattle for infection of Lumpy Skin Diseases from Nanded.
- To study the Taxonomy of LSDV.
- To study the Transmission Dynamics of LSDV.
- To Study Some Haemato-Biochemical aspects of normal and naturally infected cattle by LSDV.
- Immunological studies on naturally infected Cattle with LSDV.
- To study clinical changes in Lumpy Skin disease affected cattle.
- To study Economic Impact of LSDV.

5. METHODOLOGY TO BE USED AND ADOPTED:

- Data collection will be carried out by survey method. During study period cattle were examined clinically for the presence of LSD lesions.
- Hemato-Biochemical analysis, Immunological and clinical studies will be conducted using established standard protocols and methodologies.
- Statistical analysis will be performed by employing statistical methodologies.

Study Area: - Different collection sites in Nanded District of Maharashtra State, India.

6.Importance of the study:

The present study will be able to increase understanding about the status of lumpy skin disease in cattle.

International Status:

Lumpy skin disease has been reported in various countries across different continents, including Africa, the Middle East, and parts of Asia and Europe.

The spread of the disease can lead to “substantial” and “severe” economic losses according to FAO and the World Organisation for Animal Health (WOAH). The disease leads to reduced milk production as the animal becomes weak and also loses appetite due to mouth ulceration. The income losses can also be due to poor growth, reduced draught power

capacity and reproductive problems associated with abortions, infertility and lack of semen for artificial insemination.

National Status:

India has also reported cases of lumpy skin disease in the past. The Indian government and authorities have likely implemented measures to control the spread of the disease and mitigate its impact on livestock.

Regional Status:

As a specific region within India, Maharashtra may have experienced cases of lumpy skin disease based on its overall livestock and cattle population. The disease has spread to 35 districts and of 3.7 lakh infected livestock, 2.8 lakh have recovered after treatment, according to a government press release. The government has identified 3,985 epicentres of the disease across the state.

Scope of Studies:

The Lumpy Skin Disease (LSD) has devastating economic impact. During the last decade, LSD has spread to climatically new and previously disease-free countries, which also includes its recent emergence in the Indian subcontinent. The scope of studies related to lumpy skin disease can encompass various areas, including:

1. Disease Surveillance and Epidemiology: Studying the prevalence and spread of lumpy skin disease within regions, countries, and internationally to identify risk factors and patterns of transmission.

2. Virus Characterization: Understanding the genetic makeup and evolution of the lumpy skin disease virus to develop effective control strategies.

3. Vaccine Development: Researching and developing safe and effective vaccines to prevent lumpy skin disease in cattle populations.

4. Clinical Studies: Investigating the clinical presentation of the disease and its impact on animal health and productivity.

5. Economic Impact Assessment: Assessing the economic consequences of lumpy skin disease outbreaks, including losses in livestock production and trade.

6. One Health Approach: Considering the broader context of lumpy skin disease within the One Health framework, which involves collaboration between human, animal, and environmental health sectors to address zoonotic diseases and their impacts.

Researchers, epidemiologists, and policymakers may conduct studies in these areas to improve our understanding of the disease and develop effective measures to control and prevent its spread.

7. Proposed work planwith tentative chapter scheme:

1) Introduction
2) Preface
3) Review of literature
4) Geographical background of research area
5) Materials and methods
6) Result and discussion:
    1. Taxonomy of LSDV
    2. Transmission Dynamics of LSDV
    3. Hemato-Biochemical study
    4. Immunological and Clinical study
    5. Economic Impact of LSDV
    6. Summary and Conclusion
7) Bibliography

8. PROPOSED WORK PLAN

First year

- Review of Literature, Study of references and research methodology. Visit to various localities of Nanded district for collection of samples from infected Cattle.
- Collection, preservation and Laboratory testing of samples for Transmission dynamics, Haemato-Biochemical and Immunological aspects of normal and naturally infected cattle by LSDV. Record clinical changes in lumpy skin disease affected cattle.

Second Year

- Visit to various localities of Nanded district for collection of samples from infected Cattle.
- Collection, preservation and Laboratory testing of samples for Transmission dynamics, Haemato-Biochemical and Immunological aspects of normal and naturally infected cattle by LSDV. Record clinical changes in lumpy skin disease affected cattle.

Third Year

- Collection, preservation and Laboratory testing of samples for Transmission dynamics, Haemato-Biochemical and Immunological aspects of normal and

naturally infected cattle by LSDV. Record clinical changes in lumpy skin disease affected cattle. Data Analysis of obtained results.

Fourth Year

- Data Analysis of obtained results.
- Drafting, Typing and Submission of Thesis.

9. Expected Outcome:

- Clear understanding of how Lumpy Skin Disease Virus (LSDV) is transmitted among naturally infected cows.
- Identification of key factors contributing to disease spread within cattle herds.
- Insights into the role of vectors and environmental conditions in the transmission process.
- Detailed profiling of some Hemato-Biochemical and immunological parameters in LSDV-infected cows, aiding in understanding disease impact on blood parameters.
- Quantification of economic losses caused by LSDV infection in cattle herds, considering factors such as reduced productivity, treatment costs, and mortality.
- Evaluation of the impact of LSDV on milk production, reproduction, and overall herd health.

Overall Impact: The research outcomes will not only contribute to our understanding of Lumpy Skin Disease Virus and its effects on naturally infected Cattle but also provide valuable insights into disease transmission, immunity, pathology, and economic implications. These findings will inform improved control strategies, potentially leading to reduced economic losses in the livestock industry and better protection of both animal and human health.

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